

Experiment # 2

CMOS Inverter Characterization

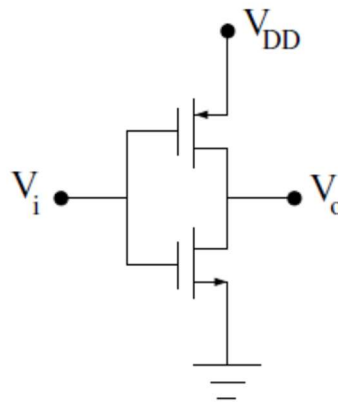
The aim of this experiment is to explore the characteristic of CMOS Inverter and its use as an amplifier.

Introduction:

Complementary MOSFET (CMOS) technology is widely used today to form circuits in numerous and varied applications. It has become the key elements in the today's integrated circuits due to several key advantages, such as low power dissipation, relatively high speed, high noise margins, etc. The CMOS inverter is one of the most basic logic circuit elements in the digital circuits.

In this lab, we will build an inverter with a NMOS and a PMOS transistor and measure its basic characteristics. And then characterize its performance as amplifier.

1. Characteristics of CMOS inverter:



- (i) **Plot V_o vs V_i by sweeping V_i from 0 to 5V.** Use $V_{DD} = 5V$, $(W/L)_{NMOS} = (2\mu m/0.5\mu m)$ and $(W/L)_{PMOS} = (4\mu m/0.5\mu m)$
- (ii) **Repeat the above plot for (A)** $(W/L)_{NMOS} = (2\mu m/0.5\mu m)$ and $(W/L)_{PMOS} = (8\mu m/0.5\mu m)$; **and (B)** $(W/L)_{NMOS} = (2\mu m/0.5\mu m)$ and $(W/L)_{PMOS} = (2\mu m/0.5\mu m)$
- (iii) **Discuss the variation in the plots (i), (ii)A and (ii)B**

- (iv) **Plot current vs V_i** on the same graph (i) and discuss its nature. **Find out at what value of V_i current is maximum and what values of V_i current is minimum.**
- (v) **Find the switching threshold = V_M** where (in Plot 1) $V_i = V_o$, **check whether V_M is exactly at $V_{DD}/2$ or not and why.**

2. Characteristics of CMOS inverter:

Bias the inverter at V_M and apply an ac signal say of 20 mV pick to pick (sine wave) of 10 kHz. **Plot V_o vs time and V_i vs time.** Find out the gain of the circuit and discuss the nature of the plot.